Original Article

MANAGING GLYCEMIC RESPONSE IN NORMAL AND HYPERCHOLESTEROLEMIC SUBJECTS USING PSYLLIUM HUSK SUPPLEMENTED COOKIES

Tahira Batool Qaisrani[*], Masood Sadiq Butt[**], Khalid Masood Qaisrani[***], Muhammad Ali[****], Muther Mansoor Qaisrani[*****], Munazza Batool[******]
[*]Assistant Professor, Ghazi University, Dera Ghazi Khan
[**]Professor and Director General, National Institute of Food Science and Technology, University of Agriculture Faisalabad, Pakistan
[***]Senior Medical Officer, T.B. and C.D. Ward, DHQ Hospital, Dera Ghazi Khan, Pakistan
[****]Lecturer, Ghazi University, Dear Ghazi Khan, Pakistan
[*****]Assistant Professor, Ghazi University, Dera Ghazi Khan.
[******]Ghazi Medical College, Dera Ghazi Khan

ABSTRACT:

Objective: Present research was carried out to evaluate the efficacy of psyllium husk based dietetic cookies as therapeutic agent for management of blood glucose level in normal and hypercholesterolemic subjects.

Methodology: Dietetic cookies were prepared by replacing wheat flour with psyllium husk. Five cookies with 3.22g dietary fibre and 1.61g arabinoxylan were provided to each (20) subject for two months twice a day along with control cookies (without psyllium husk) during two consecutive years study i.e. 2009-10 (Trial-I) & 2010-11 (Trial-II).

Design: Two factor factorial under CRD was used for statistical analyses followed by Tukey test to compare means in efficacy study.

Results: Significant differences in serum glucose concentrations in hypercholesterolemics due to treatment were obseved. Percent reduction in glucose ranged from 10.70 to 12.19% in Trial-I &II, respectively. While serum HbA1c level was affected non-momentously due to treatment in this group. In healthy subjects, non-significant differences were observed in both traits.

Conclusion: Psyllium husk enriched cookies are potent to be used as therapeutic food to manage hyperglycemia in hypercholestolemic subjects with soothening effect on healthy subjects.

Keywords: psyllium husk, dietetic cookies, hypoglycemic view, hypercholesterolemic, healthy subjects.

INTRODUCTION:

Dietary components and human health have established strong linkages reflecting the pivotal role of nutrients in normal body functioning. The health grievances like obesity, hypercholesterolemia, diabetes mellitus and cardiovascular disorders are associated with improper nutrients intake and deskbound life style. In this context, functional foods are one of the emerging implementations gaining attention as preventive and curative device against various health infirmities[1]. Presently, phytonutrients in well-being communities are animated for their health promoting potential. Food supplemented with different bioactive components is the current choice of consumers to combat various physiological threats[2].

Corresponding Author:
Dr. Tahira Batool Qaisrani
Assistant Professor, The Ghazi University, Dear Ghazi Khan, Pakistan
Phone No. 00923326922682
Email: tahira7qais@gmail.com

Modification in eating habits is important to moderate the life style relating disorders. The American Heart Association (AHA) recommends that saturated fats should be replaced with low fat diets, careful intake of foods high in cholesterol, restricted use of trans fats and increase of fiber rich foods[3]. Foods consisting of functional components like dietary fiber persuade to cure different physiological health reservations[4].

Different soluble and insoluble fibers from cereals and vegetable sources are used to prevail over the glycemic disorders occurring during the menace of hypercholesterolemia. Among these fiber sources the psyllium husk fiber is considered most effective, safe and healthy[5]. Its importance is high water soluble fiber that is responsible to appease glycemic irregularity in subjects with hypercholesterolemia. High fiber diets increase peripheral insulin sensitivity in healthy adults. Soluble fiber delays the absorption of glucose and consequently decreases postprandial glucose concentrations[6].

In USA, the National Cholesterol Education Program (NCEP) set guidelines for LDL<100 mg/dL and HDL not <40 mg/dL for prevention of stroke risk[7]. It is evident that diabetic patients are frequently victimized by hypercholesterolemia due to physiological and dietetic instability. Both syndromes have close association and occurrence of each enhances the severity of other resulting in ruthless complications in human physiology. The foremost reason is elevated levels of cholesterol and LDL whereas, HDL in blood is decreased than the recommended level. Plaques of cholesterol are formed and shrinkage of arteries may occur causing hindrance in normal blood flow thus ultimately leads to atherosclerosis[8].

Plasma glucose concentration is decreased due to psyllium enriched diet owing to its prolonged retention time of food in digestive tract while total tract apparent digestibility of dry matter significantly lowered[9]. In this context, the researchers illuminated the use of psyllium dietary fiber 10.2 g/day as intervention to attenuate the postprandial plasma glucose in subjects with diabetes mellitus[10]. One of their peers, revealed that dietary fiber intake from whole or supplemented food significantly lowered the blood pressure, serum glucose level and indication of inflammations whilst, managed the serum lipid profile[11]. It is suggested from the number of experimental and clinical studies that psyllium significantly decreased serum lipids and liver cholesterol concentration and may increase HDL.

Psyllium husk fiber 5.1 g twice a day in diet based therapy is provided to the patients with type-II diabetes that improved gastric tolerance compared to metformin (medicine) while, fasting plasma glucose and HbA1c are declined[6]. Keeping in view the above facts, psyllium husk based cookies were prepared and administered for the management of glycemic response in healthy and hypercholesterolemic subjects.

MATERIALS AND METHODS:

Indigenous psyllium husk (*Plantago Ovata* Forsk) was purchased from Qarshi Industries (Pvt.) Ltd. Pakistan. For the preparation of dietetic cookies, non-nutritive sweeteners including aspartame and sorbitol were used. The sweeteners, straight grade flour and shortening were perchased from the local market.

PREPARATION OF DIETETIC COOKIES:

Control cookies and dietetic cookies were prepared using 20% psyllium husk by replacing straight grade flour according to the instructions of American Association of Clinical Chemistry (AACC)[12]. The recipe followed for control was: 500g commercial straight grade flour, 250mL sorbitol, 0.84g aspartame, 220g vegetable shortening and 7g baking powder. These cookies contained dietary fibre (6.45±0.10%) and active soluble fibre fraction arabinoxylan (3.23±0.08%). Moreover,

physico-chemical and storage stability study of dietetic cookies has been sent for publishing elsewhere.

HUMAN STUDY:

This part of research was carried out in District Dera Ghazi Khan for two consecutive years. For efficacy purpose, the volunteers were communicated regarding aims and perspectives of the study for consumer's health view point. The written consent was taken from each volunteer to participate in the project and selection of subjects was done randomly on the basis of their anthropometric information, vital sign records and the initial values of serum lipid profile and whole blood assay for study in healthy and hypercholesterolemic subjects. Selection of volunteers was made considering that there should be non-significant differences in the base line values among healthy individuals following the same pattern for selection of hypercholesterolemic subjects. Diet schedule of each volunteer was also recorded to observe their eating behavior. The work plan for efficacy study is presented in Table 1.

Initially twenty normal subjects were selected on the criteria mentioned earlier. They were further divided in two groups of ten each. One group was provided with control cookies while other group consumed psyllium husk based cookies for two months study period. All the subjects were examined regularly to observe any difficulty. In order to find out the hypoglycemic effect of cookies, serum glucose and HbA1c were estimated. Similarly, hypercholesterolemic subjects (20) were treated in same pattern as illustrated in normal subjects to evaluate the effect of dietetic cookies on the selected traits of hypoglycemic perspectives. The trial for hypercholesterolemic subject was also repeated in next year.

The present study was approved by the Directorate of Graduate Studies, University of Agriculture Faisalabad, Pakistan.

BLOOD ANALYSIS:

Serum was collected from the blood sample through centrifugation (Model: 800, Centrifugal Machine, China) and serum was assessed for hypoglycemic perspectives using the commercial kits through Microlab-300 (Merck, Germany) [13]. Initially, serum sample of each volunteer was collected for determination of base line values. Likewise, serum samples were also drawn on monthly basis up to two months to find out the effect of fiber supplementation.

SERUM GLUCOSE:

Serum glucose concentration of the volunteers in each study was determined by GOD-PAP method by using commercial kits according to the prescribed method[14].

Glycosylated hemoglobin (HbA_1c) concentration:

HbA_1c was measured through commercial kits according to given method[6].

STATISTICAL ANALYSIS:

The obtained results were subjected to statistical analysis using Cohort version 6.1[15]. Level of significance was estimated by using the analysis of variance technique (ANOVA) using two factor factorial CRD. Further, Tukey test was applied in efficacy studies to compare the means[16].

RESULTS AND DISCUSSION:

GLUCOSE CONCENTRATION:

Serum glucose level varied non-significantly due to intake of dietetic cookies in healthy subjects during whole study period however, in hypercholesterolemic volunteers momentous variations were observed during the years 2009-10 and 2010-11.

In normal subjects (Trial-I & II), means for glucose concentration varied non-significantly from 83.90±4.34 to 81.60±0.73mg/dL and 88.60±6.79 to 82.70±3.88mg/dL whereas, 78.70±4.07 to 75.90±0.68mg/dL and 82.90±6.35 to 78.10±3.65mg/dL in CC and

DC groups at 0 and 60 days, respectively as shown in Table 2. In hypercholesterolemic individuals (Trial-I), glucose concentration varied significantly from 103.10±7.90, 98.30±8.05 and 92.07±4.11mg/dL at 0, 30 and 60 days, respectively in treatment DC rely on psyllium based cookies. Likewise pattern was observed in this group (Trial-II) with the values for glucose concentration as 102.47±7.85, 98.19±8.04 and 89.97±4.09mg/dL at 0, 30 and 60 days, respectively (Table 3).

Collective means for glucose concentration indicated non-significant variations in normal subjects during both years. Nonetheless, in hypercholesterolemic subjects, glucose concentration declined significantly ranging from 105.71±0.65 to 97.82±4.46mg/dL and 105.02±0.63 to 96.87±4.44mg/dL in CC and DC groups, respectively during the selected years (Table 2 & 3). The figure 1 illustrates that serum glucose concentration decreased from 10.70 to 12.19% in hypercholesterolemic subjects due to treatment DC whereas, non-significant decrease 6.65 to 5.30% in normal volunteers were estimated during the year 2009-10 and 2010-11, respectively, as effect of DC treatment.

HBA1C CONCENTRATION:

Non-significant effect of dietetic cookies and study intervals on HbA1c was noticed regardless of subjects *i.e.* healthy and hypercholesterolemics in both years.

Means for HbA1c in normal subjects (Trial-I & II) varied from 5.79±0.23 to 5.91±0.19% and 5.95±0.44 to 5.83±0.37% whereas, 5.80±0.23 to 5.96±0.19% and 5.81±0.43 to 5.76±0.37% at the beginning and termination of study in CC and DC groups, respectively (Table 4). Similar non-momentous trend was observed in hypercholesterolemic subjects with the means 6.63±0.26 to 6.92±0.22% and 6.54±0.49 to 6.29±0.40% whilst 6.55±0.26 to 6.72±0.21% and 6.48±0.48 to 6.27±0.40% at 0 and 60 days in respective treatment groups in Trial-I & II (Table 5). The overall means regarding HbA1c of normal individuals also showed non-significant variations from 5.83±0.04 to 5.89±0.04% and 5.82±0.08 to 5.75±0.04% while in hypercholesterolemic subjects the values for this trait were 6.76±0.09 to 6.42±0.07% and 6.61±0.05 to 6.38±0.06% in CC and DC groups during the year 2009-10 and 2010-11, respectively (Table 4 & 5).

DISCUSSION:

Findings of other researchers are in agreement with the present study. They reported significant reduction in glucose of hypercholesterolemic individuals after consuming psyllium husk[10]. Likewise some other researchers observed significant reduction in blood glucose level in diabetic patients[17]. Fiber from psyllium reduces blood glucose not only in diabetic patients but also in hypercholesterolemic individuals[18]. Afterward, delineated inverse association between serum glucose and psyllium husk was noted[11]. Researchers also explicated that low carbohydrate diet considerably mitigates the atherogenic dyslipidemia and glycemic index in humans[19]. Strengthening the current study, the scientists explored that Psyllium improves glucose homeostasis and lipid profile in obese and hypercholesterolemic subjects[20]. A Supportive study also explicated significant diminishing trend in fasting plasma glucose concentration in mouse fed on high fat diet after 12 weeks psyllium husk administration[21]. Earlier research work expounded non-momentous effect on postprandial plasma glucose concentration and insulin/glucose ratio in human subjects after consumption of psyllium fiber (2.2g/day) for three weeks[22]. In contrary, other researchers observed significant reduction in serum glucose concentration (11.1%) in healthy female volunteers with consumption of psyllium husk was also noted[23]. The variation in response may be due to gender difference indicating

varying trend in male and female volunteers after ingestion of psyllium husk[24].

The glucose lowering mechanism through psyllium husk explains that in abomasum and colon, residues of diets containing psyllium husk make more viscous matrix thereby increasing retention time of food in gastrointestinal tract (GIT) consequently, significant reduction in dry matter digestibility[9]. Psyllium husk can be used for cardiovascular care because of its ability to lower blood glucose (27.9%) and LDL cholesterol (7.9%); one of the risk factors for coronary disorders[25].

To investigate the glucose lowering mechanism of dietary fiber it was reported that it is involved in decline of glucose, free fatty acids and triglycerides concentration in human subjects and further explicated its association with reduced cardiovascular disease risk due to reduction in C-reactive protein (25-54%) [26]. Intake of dietary fiber improves insulin sensitivity, diminishes weight gain, controls GLP-1, leptin secretion and ghrelin gene expression[21].

Hyperlipidemia can be an important factor behind glycemic disorders like elevated blood glucose and glycosylated hemoglobin level in conjunction with disorders in insulin metabolism[6,10,17,26, 27]. Although some researchers reported momentous decrease in glucose and HbA1c in individuals with type-II diabetes after consuming psyllium husk[17], but recently, non-significant effect of psyllium husk on HbA1c was noted in normal individuals[10] supporting the findings of present study. Likewise, non-momentous reduction in HbA1c of hypercholesterolemic individuals was exhibited after consumption of psyllium husk[25] while significantly reduced HbA1c in diabetic patients in the same study conferring the differences due to metabolic variations in these groups[25].

CONCLUSION:

The results and discussion of this research study exhibit that dietetic cookies supplemented with psyllium husk has soothening effect on the glycemic index of the hypercholesterolemic patients and healthy subjects.

CONFLICT OF INTEREST AND FUNDING DISCLOSURE:

There is no any conflict of interest regarding this manuscript and authors are highly thankful to the national Institute of Food Science and Technology for providing funds and facilities for the research.

REFERENCES:

1. Schwager J, Mohajeri MH, Fowler A, Weber P. Challenges in discovering bioactives for the food industry. Curr Opin Biotechnol. 2008. 19:66-72.
2. Bech-Larsen T, Scholderer J. Functional foods in Europe: Consumer research, market experiences and regulatory aspects. Trends Food Sci Tech. 2007. 18:231-234.
3. Chan MY, Heng CK. Sequential effects of high fiber diet with psyllium husk on the expression levels of hepatic genes and plasma lipids. Nutr. 2008. 24:57-66.

Submitted for publication: 14-11-2016

Accepted for publication: 20-02-2017

SR #	AUTHOR NAME	CONTRIBUTION
1	Dr. Tahira Batool Qaisrani	Main idea of study, instruction in all project, data interpretation
2	Dr.Masood Sadiq Butt	Main idea of study and instructions
3	Dr.Khalid Masood Qaisrani	Instroduction and help on practical aspects of study
4	Muhammad Ali	Data analysis
5	Dr.Muther Mansoor Qaisrani	Write up and data interpretation
6	Dr.Munazza Batool	Write up and data interpretation